another described as *Kuhneromyces alpinus* by Smith.[2] A similar spore type has been observed by us in the type of *Secotium eburneum* Zeller, but at present we do not wish to transfer that species to *Setchelliogaster* because the cellular layer of the peridium is overlaid by a layer of gelatinous filamentous hyphae forming a pellicle which is the outermost layer of the peridium.

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CEANOTHUS SEEDS AND SEEDLINGS ON BURNS

Clarence R. Quick[1]

Blue Canyon, the large rocky canyon of Big Creek, a tributary of Kings River, lies in the Sierra Nevada just southeast of Shaver Lake, Fresno County, California. This canyon once supported a magnificent stand of timber and in spots still does. Portions of the northerly part of the canyon were logged with "steam donkeys" around 1915. The ecologic course of reforestation on logged or burned forest areas, especially on high-quality forest sites, is often interesting and significant. Causes for variations in the reforestation process are not fully understood even yet.

The areas of Blue Canyon logged in 1915 were clear-cut, but somehow the methods used in the logging, the weather cycle after the logging, or perhaps other and unrecognized factors caused the cutover area to regenerate timber species promptly, especially sugar pine. For a while the new growing forest was somewhat brushy, but the brush slowly gave way to the competition of the trees, mostly pine trees, and by 1945 the old cutover area in the northeast corner of Blue Canyon was a beautiful stand of pole-sized sugar pine, ponderosa pine, white fir, and incense-cedar. Sugar pine predominated in much of the stand. Some decadent brush persisted, largely in the forest openings. On a one-acre study plot in the northwest corner of section 14, T10S, R25E, were found some 180 sugar pines, mostly pole-sized trees 4 to 12 inches in diameter.

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[2] This latter seems to be congeneric with *Melanomphalia nigrescens* and *M. platensis*. Singer (1955) placed *Melanomphalia* in the Cortinariaceae, and (1957) proposed the combination *Melanomphalia alpina* (Smith) Sing.

One hot afternoon in August 1947 a sawmill near the bottom of Blue Canyon (at an altitude of about 3,500 feet) caught fire and burned. The fire escaped and spread over 4 to 5 square miles of forest in the northeastern part of Blue Canyon. The fire was stopped near the rim of the canyon at an altitude of about 6,000 feet. The one-acre study plot was completely burned—all conifers and, for that matter, all plant parts above the ground surface were killed. Burned forest extended roughly for a mile in all directions from the plot.

In 1948 some small plots were established on the burned one-acre plot to see what plants were "coming back" on the burn. Ten separate milacre plots were distributed over the old one-acre plot. (A milacre—one-thousandth of an acre—is a square with sides of 6.6 feet.) Current-season seedlings which came up in the spring of 1948, the first spring after the burn, and resprouts from subsurface parts of plants which survived the burn were counted and recorded.

From the 10 milacres were removed 281 seedlings of Mariposa manzanita (*Arctostaphylos mariposa* Dudley), 1,204 seedlings of Sierra Nevada gooseberry (*Ribes roezli* Regel), and 1,994 seedlings of deerbrush (*Ceanothus integerrimus* H. & A.). This is a total of 3,480 seedlings of these three brush species on 10 milacres (1/100 acre).

From a single milacre were removed 83 manzanita seedlings; from another, 612 gooseberry seedlings; and from still another, 1,814 deerbrush seedlings. Subsequent checks of these milacre plots showed that no current-season seedlings of these three species came up in 1949 or in 1950. No conifer seedlings appeared on the milacre plots, and almost none within the boundaries of the old one-acre plot.

This ability to germinate suddenly after fire is characteristic of the seeds of several genera of shrubby plants in California; see, for example, Jepson (1925). Species which react in this way are commonly called firetype plants. Seeds of firetype species are mechanically durable, long-lived, and come to be relatively ubiquitous in the forest floor of the Sierra Nevada. Quick (1956) has shown that large numbers of many kinds of seeds are "stored" in the duff even under virgin stands of timber. Quick (1935) has also shown that treatment in boiling water plus stratification will condition seeds of many species of *Ceanothus* L. for immediate germination.

The longest treatment in boiling water of the experiments reported in 1935 was 5 minutes. This treatment resulted in very satisfactory germination in some species, and it was obvious that the limit of tolerance of some collections was not closely approached. So the question arose, just how much exposure to boiling water, for example, will *Ceanothus* seeds endure?

To seek an answer, samples consisting of 100 airdry seeds of deerbrush and of mountain whitethorn (*Ceanothus cordulatus*) were treated in the Berkeley laboratory by tossing them into a screen sieve suspended in vigorously boiling tap water. After treatment, the sieve and seeds were removed from the boiling water, soused in cold water, planted in autoclaved river sand, stratified to obviate embryo dormancy, and germinated

in a greenhouse. Samples of seed collection Q#026 (deerbrush, collected on the South Fork of Stanislaus River at about 4,800 feet altitude) were treated in boiling water for 1 to 20 minutes. Twelve per cent of these seeds germinated after having been boiled for 20 minutes. Samples of seed collection Q#239 (mountain whitethorn, collected near Strawberry, Stanislaus National Forest, at about 5,400 feet altitude) were treated for 5 to 30 minutes in boiling water. Twenty-five per cent of these seeds germinated after being boiled for 25 minutes, but none germinated after being boiled for 30 minutes. A manuscript, now nearing completion, will analyze statistically the seed germination reactions of several species of *Ceanothus* with respect to seed age, altitude of seed collection, length of exposure to boiling water, and temperature and length of stratification treatment.

Many seeds, even *Ceanothus* seeds, are destroyed in any forest fire, but the above preliminary experiments suggest that seeds of many firetype plants are very durable, long-lived, and sufficiently resistant to high temperatures to escape destruction and to completely revegetate a heavy burn. Thus starts the first stage in a new cycle of forest development.

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CHROMOSOME NUMBERS OF CALIFORNIA PLANTS, WITH NOTES ON SOME CASES OF CYTOLOGICAL INTEREST

Richard Snow

Meiosis has been examined in microsporocytes of various species of Californian plants, and the resulting chromosome numbers are listed in Table 1. During the course of these observations several meiotic phenomena have been observed that have cytological interest beyond chromosome number. These will be discussed briefly in order to point out some areas possibly worthy of further study.

Methods. Buds were fixed in 1:3 acetic-alcohol for one to several days and stored in 70 per cent alcohol under refrigeration. After soaking in water for a few minutes the material was softened in 1N HCl at 60°C. for 5–10 minutes, rinsed with water, and the anthers squashed in aceto-orcein or aceto-carmine. The *Fritillaria* material was stained by the Feulgen reaction. Permanent slides were made by Bradley's (1948) method, without removing the coverslip.